HF-jet TG work/plan and coordination with JS TG

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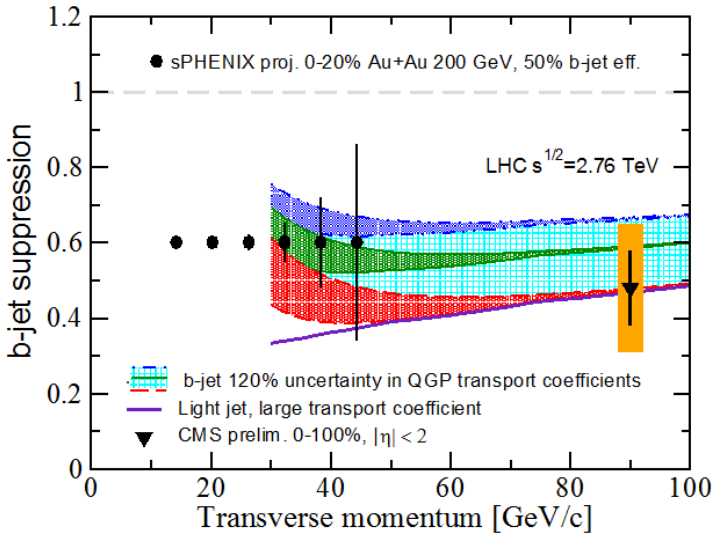
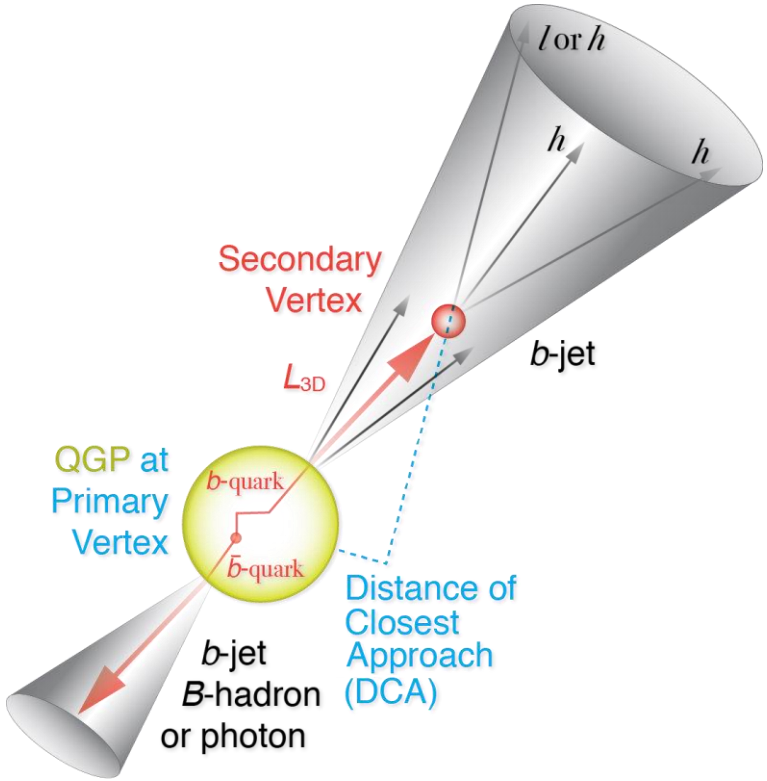
Introduction

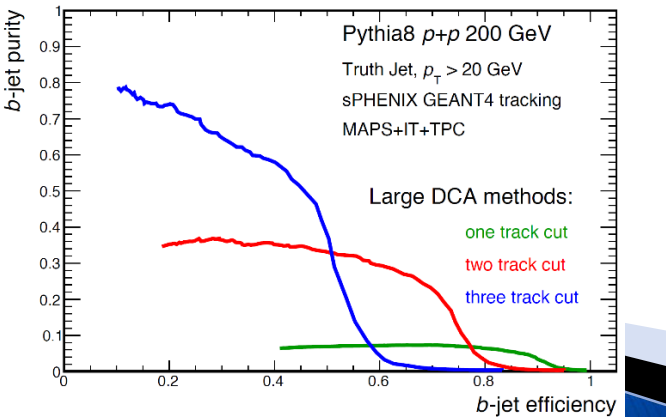


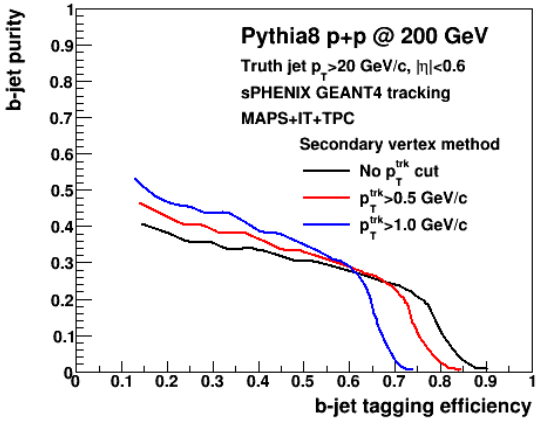


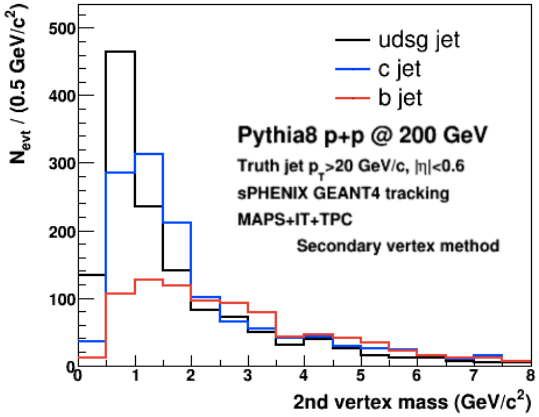
- HF-jet: in particular *b*-jet, when compared with much more abundant light-parton jet, provide differentiating sensitivity to collision VS radiative energy loss
- Detection technique employed: Jet + jet structure information enhancing *B*-hadron fraction, i.e. displaced track, high mass secondary vertex and enhanced leptonic decay products

HF-jet TG high priority longer-term tasks

- Goal: realistic study of HF jet performance in sPHENIX simulation and reconstruction.
- High priority development tasks : (current developers and your help welcomed!)
  - Realistic implementation in Geant4
    - Tony F./Gaku M./Chris P.: pull request submitted in the past week
  - Generalized Kalman filter
    - Haiwang Y./Chris P., ready, used in analysis, better understand details
  - Multi-vertexing/*b*-tagging via secondary vertexing in jet
    - Sanghoon L./Haiwang Y.: ready, used in analysis, push towards HI analysis
  - *b*-jet tagging: Track Counting
    - Haiwang Y./Dennis P.:
      ready, used in analysis, push towards 3-D DCA and HI analysis
  - *b*-jet tagging: Soft Lepton Tagging, exploratory
  - *b*-quark jet selection: B-Meson Tagging
    - Exploratory, volunteers from LANL and LBNL
- Area of overlapping with JS TG in next few slides
  - Jet detection / modern jet structure tools / event and jet flavor tagger

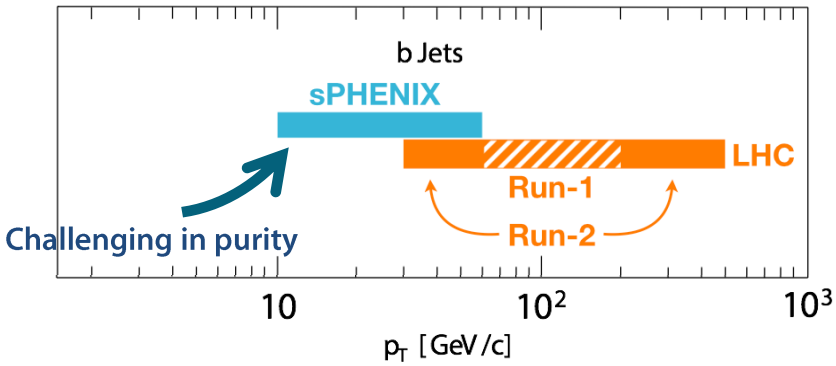




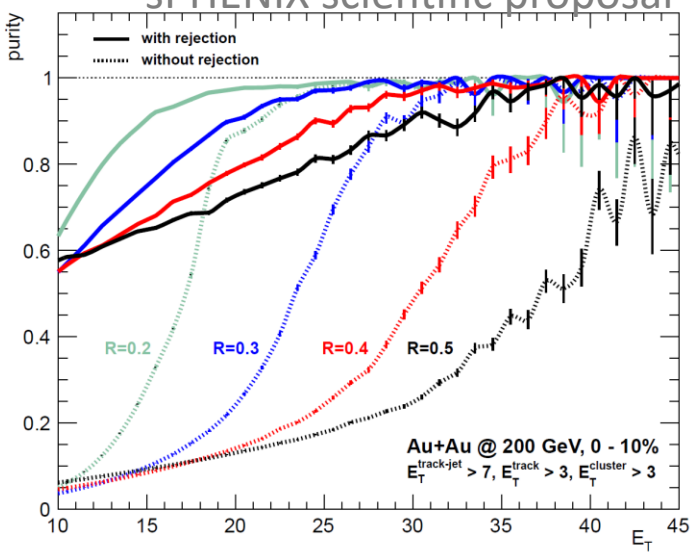


Area of collaboration: Jet finding

- HF-jet are based on jet, relying on jet finding development lead by JS TG
  - Emphasis on purity and reach to lowest-possible-p_T jet, where mass effect is maximized
  - No statistics for *b*-jet beyond $p_T > 50$ GeV/c
- HF-jet specific: response in detector for b-favored jet, unfolding and media modification
  - Require join study with JS TG in term of experience and toolkit developments

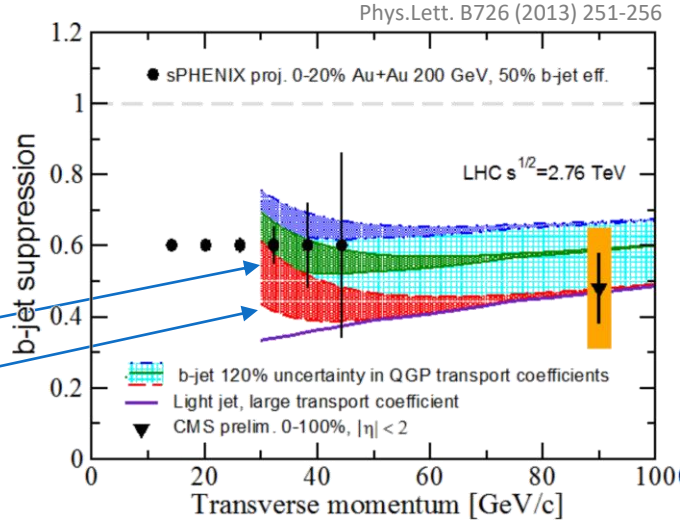


sPHENIX scientific proposal



Area of collaboration: Jet grooming

CMS, Phys.Rev.Lett. 113 (2014)
Phys.Lett. B726 (2013) 251-256



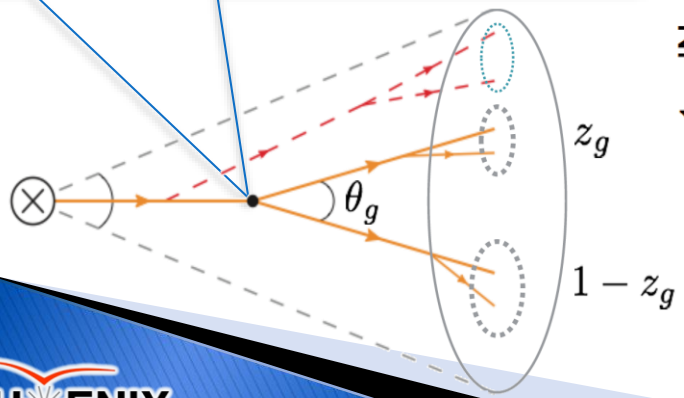
Two category of *b*-jets in term of QGP responses:

- $g/q \rightarrow b\bar{b}$ jet, expect small fraction @ RHIC ?
- *b*-quark jets

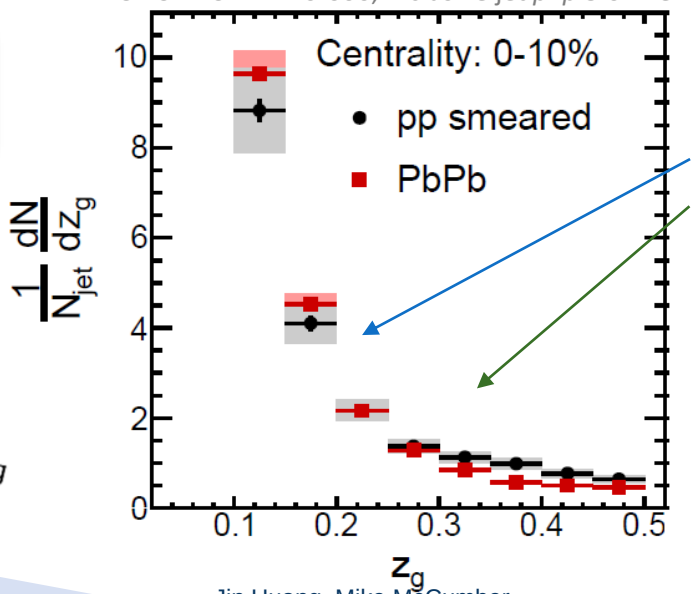
Differentiation relies on

- Correlation, + b-jet, B-hadron or photon
- Or jet structure, e.g. the jet grooming observable z_g?
  Will be very interested in collaborate in developing grooming tools

Earliest splitting:
More symmetric for $g/q \rightarrow b\bar{b}$ jet?



CMS-PAS-HIN-16-006, inclusive jet *p*+*p* 5.02 TeV



- *b*-quark jets ??
- $g/q \rightarrow b\bar{b}$ jet ??

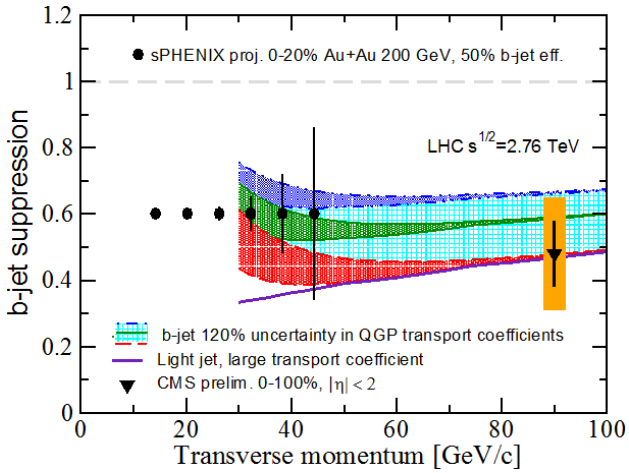
A+A Modification would enhance z_g~0.5 (i.e. $g/q \rightarrow b\bar{b}$ less suppressed)?

Outlook

- HF-jet is specialized jet structure study, focusing on enhancing b-quark jet
- Expect close collaboration on jet finding and jet grooming studies
- The next goal driven event for HF-jet TG : joint MAPS detector group workfest, early Jan 2017
  - https://indico.bnl.gov/conferenceDisplay.py?confId=2641
  - Jan 5-7 @ Santa Fe. Jan 5: talk w/ bluejeans. Jan 6-7 work days.
  - Goal: finalize simulation plots for MAPS MIE proposal + QM17. Make major progress towards MAPS MIE proposal. Generic simulation dev.
  - Welcome to join for jet simulation development too. Announcement today.

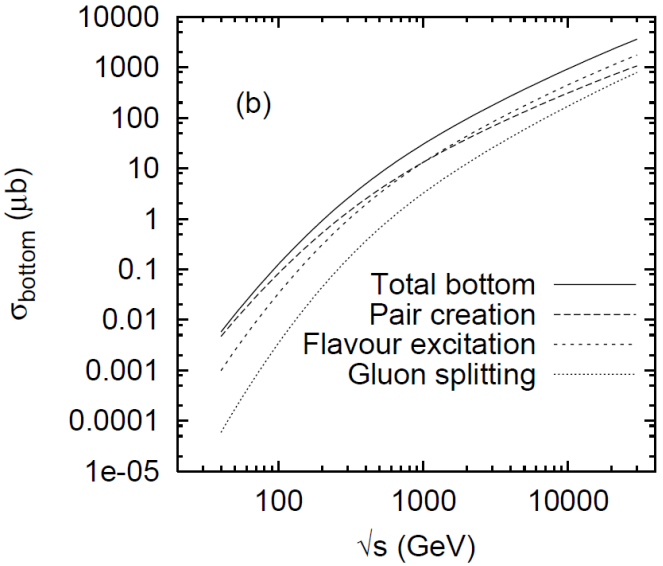
Extra information

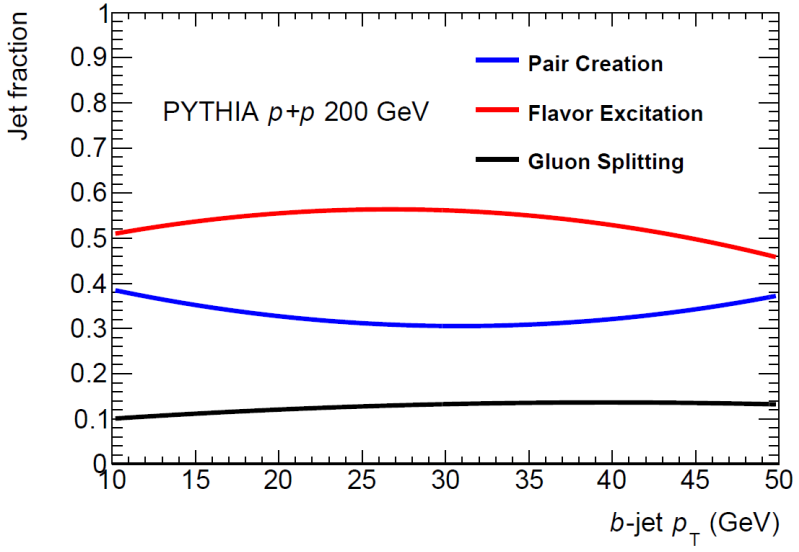
Overview



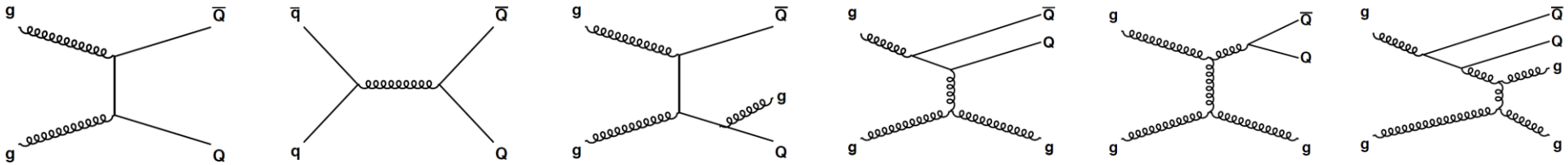
- Target B-jet tagging performance plots
  - High DCA track counting : Established G4-based procedure in p+p
  - Secondary vertex: Developed RAVE based secondary vertex finder. Results in in p+p
  - **Next**: Reevaluate tagging in central Au+Au embedded events and pile up
  - Unifying truth definition and jet sample generations
    - Based on Dennis' work defining a truth tagging module run on MB events to synchronize B-jet definition and yield between analyzers
    - Available on GitHub: https://github.com/sPHENIX-Collaboration/analysis/tree/master/HF-Jet/TruthGeneration
- Regular updates on B-tagging simulation utilizing weekly simulation meetings: https://indico.bnl.gov/categoryDisplay.py?categId=88

Pythia b-jet fraction



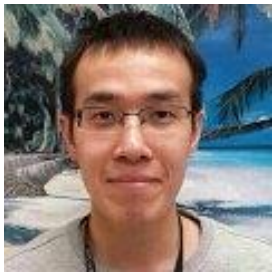


Lund String, Eur. Phys. J. C 17, 137–161 (2000)

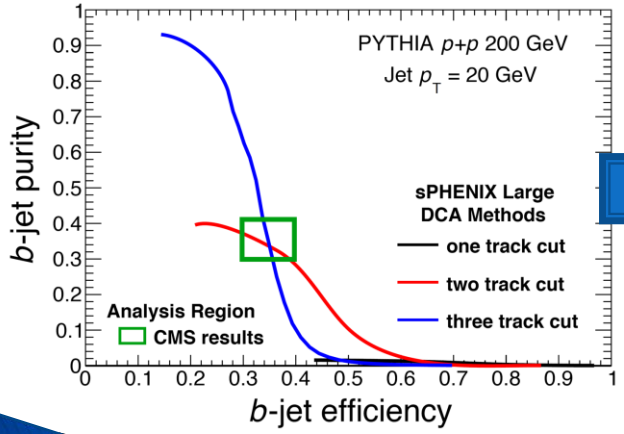


B-jet tagging – High DCA track counting

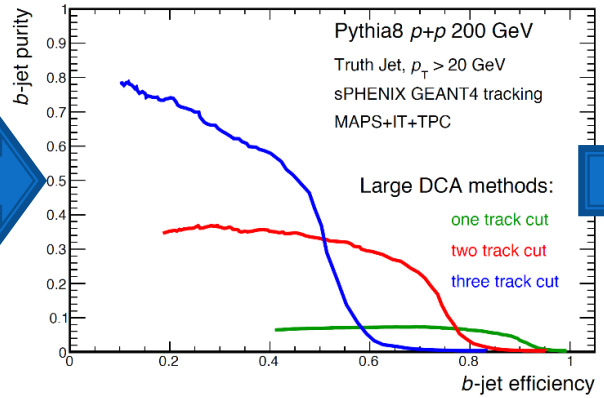
- Progress since last general meeting
  - Dennis and Haiwang implemented track counting tagger in the full Geant4 simulation
  - Haiwang produced projection plot in
- On-going past few weeks
  - Systematically validating the Geant4-based track fit procedure, in order to optimize 3-D DCA and likelihood
- Next
  - Reevaluate in HI background with HIJING embedding



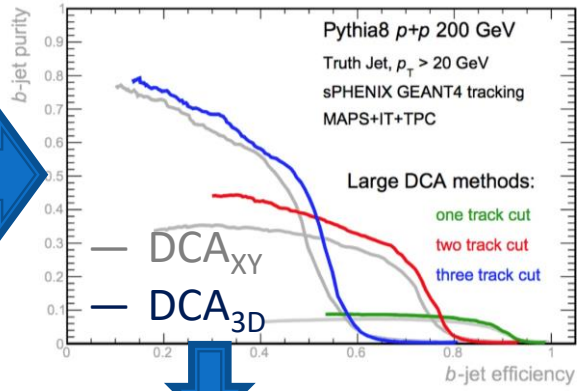
Fast sim in Proposal



Full Geant4 Sim in G4 (DCA_{XY})



Exploring 3-D DCA in G4
NOT optimal tune yet!

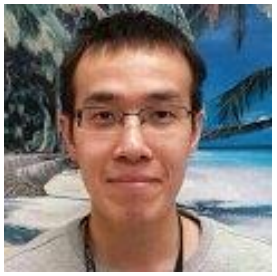


From Haiwang's talk
https://indico.bnl.gov/conferenceDisplay.py?confId=1926

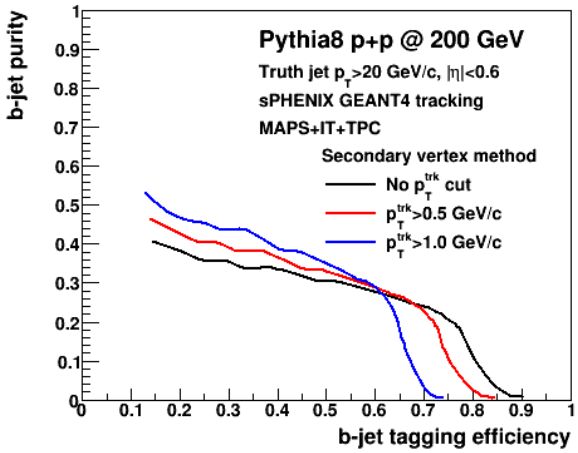
b-tagging performance in HI

B-jet tagging – Secondary vertex

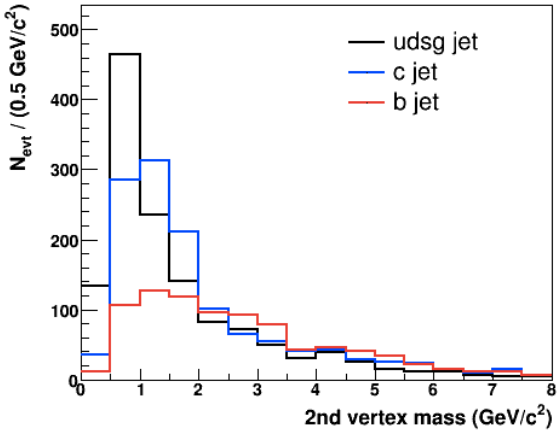
- Progress since last general meeting
  - Haiwang developed new Kalman filter (GenFit2) with vertex finder integration (RAVE)
  - Sanghoon implemented Secondary vertex finder in jet
  - p+p performance plot used in tracking review
- Plan next:
  - Reevaluate in HI background with HIJING embedding



Secondary vertex b-tagger



Secondary vertex kinematics fits
Data driven b-jet purity estimation



b-tagging performance in HI

From Sanghoon's talk
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